Just in Time Learning

Current market conditions have created a shifting workforce and a demand for technological change that is unprecedented. Layoffs and failed ventures have demanded that employees be able to shift job responsibilities quickly – often assuming positions for which they are not adequately trained. In response, enterprises have begun to implement innovative techniques to keep their employees up to date in the newest technologies. Depending upon the industry either the employee turnover is so high that there often is not time for comprehensive training, or the technology changes so quickly that retraining a firm’s workforce becomes a daunting task. PricewaterhouseCoopers states that 70% of the world’s 1,000 top-tier companies cite lack of trained employees as their number one barrier to sustaining growth. (Forbes, 2001) “Today, companies want "just in time" training solutions, says Ovum (i.e., an employee encounters a problem, and gets immediate help to solve it right then and there). The traditional, long lecture format in which trainees had to take in large amounts of information and figure out when to apply it in a work context is a thing of the past.” (Ovum, 2001)

Often there isn’t time for thorough training and an employee is thrust into a new situation without previous experience – often resulting in disastrous consequences. Whereas having an unknowledgeable sales staff member at a retail store is damaging to the company’s customer service reputation and ultimately the bottom line, the employee’s health is not endangered. In other industries, however, not knowing how to react to a new situation can be fatal. Many industries are providing just-in-time learning by combining elearning with wearable computers to provide hands-free workplace learning. Consider the following scenario: an emergency worker arrives on the scene of an earthquake and can instantly view architectural blueprints for damaged building and can assess the structural stability before entering. This is the kind of just-in-time information that can be presented to a field worker by combining wearable computing with elearning to create a truly mobile worker and learner.

“Traditional” Web-Based or Virtual Elearning
In traditional academic institutions, web-based learning systems are generally housed administratively in a "distance education" department alongside other at-distance delivery methods such as correspondence, satellite broadcast, two way videoconferencing, videotape and CD-ROM/DVD delivery systems. All such systems seek
to serve learners at some distance from their learning facilitator. Many such systems attempt to serve learners interacting with the learning source at different chronological times (for example, email). Others stage web broadcasts to educate all their employees at once. Ford, for example, uses a multitude of different approaches to educate its global workforce: from online knowledge bases that employees can query with questions, to self-paced online classes, instructor-led web broadcast classes, and virtual teaching assistants that can provide just-in-time learning.

Learning that is provided just-in-time can take many forms and many enterprises use corporate intranets, videos or CD-Roms for desk-stationed employees to access information instantly and as needed. Currently researchers at the University of Southern California (USC) are taking the concept of video training to the next level with the development of enhanced reality training rooms by which “Soldiers use holographic viewers to drive tanks that recoil and smell of cordite when the virtual shells are launched.” The Army hopes this will allow them to train their troops on what the streets of a foreign city look like before they are deployed. (Stroud, 1999) Recently researchers at USC began developed Mech Commander and Mech Warrior 3 Games that train their leaders to learn how to get a team to clear a house, protect aid workers or hold off a mob from a US embassy. (Schachtman, 2001) In the civilian realm, yet not quite as reality based, many companies are focused on how to train their workforces that are geographically dispersed AND mobile. For mobile workforces, access to corporate intranets isn’t practical and research into how to “wire” your employees so that they can learn critical information as quickly as possible has lead many companies to explore the use of wearable computers to create a mobile learning experience.

The Realm of Wearable Computing
A true wearable computer can be operated hands-free and used while the wearer is moving around. It is always on and has sensors (including wireless communications, cameras, microphones or Global Positioning Systems) for the physical environment and can convey information to users even when inactive. Wearable devices are predicted to become even smaller and more un-obtrusive in the future as components shrink in size. Even the need to carry a battery pack may be eliminated by the MIT Media Lab’s research into a shoe that is a part of a personal area network that turns the body into a “wet wire’ for transmitting data. This shoe generates power when the user walks on top of flexible film sensors loaded in the soles that generate current by being flexed back and forth. (Bass, 1998)
One of the keys to the usefulness of wearables is their ability to display information to the user via a pair of eyeglasses that do not restrict the user’s normal vision. Initially developed by the Human Interface Technology Lab at the University of Washington\[K1\], Virtual Retinal Display devices display what a user would see on their monitor and displays it directly on the retina in a full color, high resolution, wide-field of view screen. The image looks like it’s floating in front of the user and the device can be used without a light source. (Bass, 1998) With these devices, surgeons could perform image-guided surgery; maintenance professional could view manuals and share and coordinate blueprints as they worked.

Implementation of Mobile Learning
How is this type of technology used within the workplace to deliver elearning? Boeing has implementing wearables in their wiring shops. Mistakes in wiring a airplane can be costly and the wiring complexity previously required assemblers to bounce from computer printouts to the formboards to see which wire bundles get linked to which connectors. Builders sometimes work with only a single wire at a time, using schematics glued to the boards. Not any more. Now by wearing a headset with microphone, voice recognition software and a transparent eyepiece that works as a display, mechanics are able to access the aircraft manual verbally and have it displayed before their eyes. They can then overlay the wiring diagram on top of the piece of the aircraft in front of them and due to the unit’s ability to track the user’s head movements, the appropriate schematics zoom into view no matter where the user gazes. (Nash, 1997)

Other research institutions have experimented with wearable technology in a range of other industries. Georgia Tech Research Institute (GTRI) for instance, has created two Factory Automation Support Technology (FAST) devices that are being used in the poultry industry by managers who need to monitor inventory without dirtying paperwork. (Sanders, 1999) “(Mobile technology) is intended to support mobile employees as they perform a job, rather then train them before,” said Chris Thompson a senior GTRI researcher. (Sanders, 1999)

Mobile Learning in Adverse Conditions
Various research centers are developing systems that will educate the user about their surroundings as well as provide them essential timely information in adverse environmental conditions. "With wearable technology, it doesn't matter if they're down in a manhole or up in a
loft," said Brad Chitty, general manager of mobile communications services at Bell Canada, in North York, Ontario. "They always have access to customer information as opposed to having to go back to the office or the truck." (Nobel, 2001) NASA’s Jet Propulsion Laboratory has developed such augmented reality systems for astronauts. Their prototype, WARP (Wireless Augmented Reality Prototype) can relay to the astronaut her vital signs, the spacecrafts system status, and owner manual displayed in an LCD eyepiece while simultaneously communicating all of her actions to ground control. (Britt, 2001) The ability to control troops using wearable technology is currently being demonstrated. No longer do troops need to be within hearing range to receive orders, and military medics could instantly address health concerns or injured soldiers by reading their biometric signs and locating them with GIS location devices. Soldiers could received new navigational maps and blueprints within their LCD devices-eliminating the need to re-group to educate the troops on new battle plans and individual troop movements could be tracked while in the field allowing the commander to maintain control of his team at all times.

Computer hardware can be very vulnerable to environmental conditions and stress. Wearable hardware isn’t truly transparent and usable if it is not able withstand the user’s environment. The company WetPC has addressed this issue by creating a wearable device that can be used underwater – an invaluable tool for industries that need to provide just in time information and training to underwater divers. Originally conceived and developed at the Australian Institute of Marine Science (AIMS) it is composed of a miniature personal computer with a mask-mounted virtual display and a novel 5-button chordic graphical user interface. Field trials have shown that the computer can be steered using one hand and be easily operated (even using gloves) whilst swimming. This system allows the diver to conduct a variety of tasks including: navigation and positioning, mapping and monitoring, task planning, and information retrieval (such as maps, user manuals and schematics) and data transmission. It also allows for the monitoring of diver movements from the water’s surface. (WetPC, 2001) Imagine learning about the different species of fish or underwater formations as you swim by and being able to record your reactions immediately.

Overcoming Geography with Wearable Technology

Overcoming limitations of geography is one of the impetuses for elearning. Researchers with the Office of the Future Project at the University of North Carolina Chapel Hill are working on blending holography, virtual reality and conferencing to create meeting
experiences in which the subjects are viewed as within the same place. On May 9, 2000 the virtual images of a researcher in Armonk, NY and a postdoctoral fellow at the University of Pennsylvania appeared in a telecubicle set up at UNC Chapel Hill. (Lanier, 2001) This type of device allows for physical demonstrations and for the capturing of the actions of the presenter and the meeting members. Like the first transcontinental phone call, the quality was scratchy. It was also jerky, updating around three times a second rather than 10, the minimum speed needed to capture the full range of facial expressions. And it only worked one-way: the people in Armonk and Philadelphia couldn't see Chapel Hill. Nevertheless, it moved UNC video services manager Thomas Cox to say: "It looks like somebody took a chainsaw and cut a hole in the wall and he's on the other side." (Stroud, 2001)

Schoolchildren in China, Australia or Britain could walk beneath massive dinosaur bones in a museum in New York. Patients in remote areas could see a doctor. And once haptics - touch simulators (where the information processed by the computer is input from touch sensors) (Stroud, 2001)- are built in, people could use tele-immersion to come together in even stranger ways. A woman in Europe could reach out and touch her newborn grandchild in the US.

High quality tele-immersion will require more bandwidth than what is currently available (e - around 1.2 gigabits per second) which leaves the implementation of this type of technology unrealistic-for the time being. (Ananthaswamy, 2001) Considering the rate of technological advancements, however, enterprises could be using teleimmersion effectively within the next 15-20 years if not sooner. There has already been preliminary corporate interest in teleimmersion. The fast-food chain McDonalds showed interest at one early workshop, says Tom Defanti, one of the researchers from the University of Illinois at Chicago. "McDonalds envisioned fitting tele-immersion booths in its restaurants so people away from home could have dinner with their family. "The technology for that is not that far off," says Defanti. (Ananthaswamy, 2001)

There are other virtual solutions to holding meetings for geographically dispersed employees. Subjects involved in the CAVE (Cave Automatic Virtual Environment) at the University of Illinois at Chicago are able to interact with virtual objects by wearing lightweight stereo glasses. Imagine flooding your workspace with a CAVE or tele-immersion set up which projects an off-site trainer into your office. Currently haptic sensors (devices that react to touch) are being developed that would allow you to reach out and feel the sensation of a handshake with your remote collaborator. (Barbian, 2001) These types of technologies could
be very beneficial for just in time training for surgical procedures and trauma surgery training when the expert physician is miles away.

Mobile learning can be very effective as a learning tool for employees and can be a life-saving device during situations where just-in-time information is essential. Research by Microvision has demonstrated that mobile learning is more than twice as effective as traditional learning applications. “A clinical trial conducted by Microvision for novice automotive mechanics demonstrated an increase in training efficiency between 60 to 80 percent when traditional paper training was uploaded into VRD devices.” (Barbian, 2001) As enterprises become more global, all industries will begin to equip their staff with some type of wearable devices in an effort to keep their staff educated and well prepared for whatever may arise.
References:
Barbian discusses the future predictions for elearning and virtual training as proposed by various R&D labs throughout the country.

Provides an overview of the technology presented at two wearable computing conferences hosted by MIT Media Lab and the Institute of Electrical and Electronics Engineers Computer Society.

Britt explores NASA’s Jet Propulsion Laboratory’s newest developments in wearable technology for the astronauts and space program.

Displays a special advertising section that presents the case for elearning and provides information about elearning vendors.

Lanier discusses the history of virtual reality and tele-immersion and the demonstration conducted by University of North Carolina at Chapel Hill and the challenges tele-immersion research faces in its future developments.

Nash examines Boeing’s use of wearable technology for its factory floor workers.

Ovum Research http://www.advisor.com/Articles.nsf/aid/SMITT187
Retrieved November 26, 2001 on the World Wide Web. Addresses research into the current focuses and corporate needs that are impacting the future of elearning.

Announces the development FAST (Factory Automation Support Technology) prototype and the research conducted on its application within workforce situations.

Schachtman outlines the Army’s interest and funding of games that assist in training their military leaders.

Stroud explains what haptic technology is and what it might be used for as a part of his coverage of the recent Emerging Technologies Exhibition at the Siggraph conference.

Stroud outlines the Army’s funding of research into virtual training for its troops.

Retrieved from the World Wide Web on November 28, 2001
Corporate website outlining their WetPC and other wearable technology.
Who?